

## WORKSHEET ON MOVING-KNIFE PROTOCOLS

### PROBLEM ONE-The MK Protocol for Proportional Allocation

1) Consider the  $n = 3$  MK protocol for proportional allocation.

a)  $A$  is planning on yelling when the knife is at the  $\frac{1}{3} + \frac{1}{10}$  point (so cheating). Show that she might end up with less than  $\frac{1}{3}$ .

b) Generalize the protocol to one that is for  $n$  players and uses  $n - 1$  cuts.

### PROBLEM TWO-

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**PROBLEM THREE-ALL PLAYERS HAPPY**

Give a protocol with five people  $A, B, C, D, E$  and a pie  $P$  such that

- 1) All but  $T$  of the pie is allocated.
- 2)  $A, B, C, D$  all get  $\geq X$  (YOU FILL IN THE  $X$ ).
- 3) The allocation is envy-free.

**PROBLEM FOUR- ALL BUT  $\epsilon$  ENVY FREE**

Let  $\epsilon > 0$ .

Give a protocol All-but- $\epsilon$  Envy-Free where:

- 1) All but  $S$  of the pie is allocated.
- 2) The allocation is Envy-Free
- 3) All of the players think  $S \leq \epsilon$ .